Capstone Project Proposal:

Spacecraft Control Center Training and Testing Environment

Customers: Prof Laskey (Applied Aviation – Space Flight Ops), Prof Garfield (EECS – Comp Science)

Overview: Many people are familiar with the iconic photographs of NAS and NASA-contracted engineers sitting at consoles during the launch of space flight vehicles, or interacting with the International Space Station (ISS) from the control center in Houston, TX. This project aims to create a small-scale simulated version of a control center for use in testing and training of students in the Space Flight Operations degree program at Embry-Riddle Aeronautical University, Daytona Beach (ERAU-DB) campus. The simulated control center (SCC) will allow students to monitor and control individual systems within a simulated spacecraft in order to learn through hands-on experience the techniques and challenges of console operations. The simulated system will allow a test conductor to present the console team with off-nominal spacecraft behavior to give students practice in trouble-shooting and recovering from vehicle component deviations and failures.

Components and Functionality:

The major components of the system are the simulated spacecraft, simulated control consoles (4 – 5 unique consoles anticipated), control team communication system, simulation command and control infrastructure, and test conductor system. These are explained in more detail below.

Simulated spacecraft (SimCraft)

Simulated Control Consoles (consoles): The simulated control consoles each provide monitoring, command, and control capabilities of a specific system aboard the SimCraft. The console simulations approximate how a real world control team performs space flight operations procedures. Each console interfaces with the appropriate simulated systems in the SimCraft to allow for monitoring and control of those systems.

Members of the control team will rehearse specific scenarios representing typical spacecraft housekeeping or mission functions. The control team will be provided with procedures through which spacecraft functions may be exercised. In some testing/training scenarios the test conductor may present off-nominal behaviors or conditions to the control team so they may rehearse troubleshooting and recovery procedures.

Control Team Communication System (Comms): The Comms system provides voice communication capability across the control team. The Comms system may potentially be composed of several channels so that sub-sets of the control team may address a specific operation or issue without interfering (or being interfered from) communications with team members not involved in the immediate action. All voice communications are to be recorded for potential after action review.

Simulation Command and Control Infrastructure (SCC): The simulation command and control infrastructure provides the capabilities for the test conductor in charge of the training activity to

monitor the actions of the SimCraft controllers at their consoles. For example, the test conductor is able to verify that console operators are correctly following procedures, or responding appropriately to off-nominal situations injected by the test conductor. This infrastructure should maintain a log of all actions performed by the test conductor, SimCraft, and all console operators for after action review.

Test Conductor (TC): The test conductor system provides complete command and control of the entire simulation to the TC to allow for creation of scripted scenarios, injection of unplanned events in a scenario, observation of console operator activities, participation in the Comms system as needed by the scenario, and annotation of significant events in a simulation log file(s).

Ideally these systems are to be as modular as possible.

As a minimum, the overall system will support any scripted scenario for a specific, fixed SimCraft and associated console design.

Ideally, the system would allow for the creation of alternate SimCraft and appropriate console capabilities. That is, the system is more a simulation creation engine than a static simulation. This is clearly a stretch goal.